

## 1.0 REMEDIAL ACTION OBJECTIVES

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*[This text presents Lower Willamette Group (LWG) proposed Remedial Action Objectives (RAOs) as they would appear in the RAOs section of the Portland Harbor Feasibility Study (FS) Report. The RAOs will be refined over time as the FS is developed, but such refinement is not expected to include adding or subtracting major components or concepts from each RAO. RAOs will be refined after the draft human health and ecological risk assessments are made available to EPA and DEQ. Refinement is expected to include revising supporting text for each RAO to better explain the rationale, purpose and application of the RAOs in the context of a useful FS. It is also expected that additional introductory and subsequent surrounding language may be eventually developed, as appropriate, to fully describe the context and application of the RAOs. However, the following text is intended to propose a concrete example of the “core” of the FS RAOs section. These RAOs will be used to evaluate remedial action alternatives in the Portland Harbor Feasibility Study and as the basis for the evaluation, design and implementation of upland source control actions being performed under Oregon Department of Environmental Quality oversight.]*

This section presents the Remedial Action Objectives (RAOs) on which the analysis of remedial actions in the FS will be based. The RAOs build upon the preliminary RAOs developed for the RI/FS Programmatic Work Plan by refining the objectives to incorporate site-specific contamination and risk information developed in the RI. The RAOs were developed consistent with the US EPA Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA 2005). Key elements of the guidance that the LWG relied upon include:

1. “RAOs are generally used in developing and comparing alternatives for a site and in providing the basis for developing more specific RGs, which in turn are used by project managers to select final sediment cleanup levels based on the other NCP remedy selection criteria.” (§2.4).
2. “RAOs are intended to provide a general description of what the cleanup is expected to accomplish, and help focus the development of the remedial alternatives in the feasibility study.” (§2.4.1)
3. “RAOs are typically derived from the conceptual site model (Section 2.2), and address the significant exposure pathways.” (§2.4.1).
4. “The development of RAOs should also include a discussion of how they address all the unacceptable human health and ecological risks identified in the risk assessment.” (§2.4.1)
5. “Sediment sites also may need RAOs for other media (e.g., soils, ground water, or surface water). When developing RAOs, project managers should evaluate whether the RAO is achievable by remediation of the site or if it requires additional actions outside the control of the project manager. For example, complete biota recovery may

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depend on the cleanup of sources that are regulated under other authorities. The project manager may discuss these other actions in the ROD and explain how the site remediation is expected to contribute to meeting area-wide goals outside the scope of the site, such as goals related to watershed concerns, but RAOs should reflect objectives that are achievable from the site cleanup.” (§2.4.1).

The LWG responsibility under the Administrative Settlement Agreement and Order on Consent (ASAOC) and Statement of Work (SOW) and under CERCLA is to develop an FS that addresses the contribution of chemicals of concern (COCs) in sediments to overall unacceptable risk levels for human and ecological receptors in the site through an in-river sediment-focused cleanup. COCs are the chemicals identified in the RI/FS risk assessment that represent unacceptable health risks to humans or ecological receptors through a variety of direct and/or indirect exposure pathways, such as through contact with sediments and surface water or through ingestion of fish or shellfish. In this context, the term sediment is defined as noted in Section 1.1 (i.e., soils, sand, organic matter, or minerals along with the associated pore water). In assessing the need for remediation, the primary focus is on exposures that result directly (i.e., direct contact) or indirectly (i.e., sediment contamination of surface water, and foodweb exposures) from COCs in the current bioactive layer of surface sediments and subsurface sediments that could become surface sediments in the future (e.g., through erosion or maintenance dredging).

Human and ecological receptors are exposed to COCs in multiple media other than sediments including surface water, fish, shellfish, and vegetation. A portion of the COCs in these other media can be attributed to sediment contamination, but sources other than sediment contamination also contribute. Remediation of sediments within the site will be protective of human health and the environment (including sediment contribution to surface water and biota). However, the sediment remedy by itself is unlikely to reduce overall exposures to acceptable levels because contributions of COCs from other sources within and outside the site are substantial. This RI/FS seeks to reduce or eliminate the contaminant contribution from sediments, and thereby reduce exposures and health risk for all receptors of concern. The RI also seeks to identify sources of COCs to the surface sediments and surface water in the site in order to evaluate the potential for recontamination and to provide information to other programs that focus on eliminating or attenuating COC sources to the river.

The RAOs presented below are specific to the anticipated scope of the Portland Harbor Feasibility Study for the in-water portion of the site. Broader Management Goals aimed at managing or reducing COC contributions from other sources are described in Section 1.3 below, and are generally addressed through a variety of federal and state statutes, initiatives, or programs (EPA 2005, §2.4.1). The CERCLA RI/FS is one component of a comprehensive river improvement for Portland Harbor and the overall Willamette River watershed. EPA and the LWG have a responsibility to ensure that cleanup of sediments within the Portland Harbor Superfund Site are coordinated, to the extent required under law for a Superfund site, with these other programs.

**Comment [c1]:** Rather than deleting reference to “surface” sediments altogether per EPA’s edits, this wording provides a more specific definition of what sediments are or could pose risks, which is the focus of the FS.

Important definitions of terms used in the RAOs are described in Section 1.1. The proposed RAOs and supporting text are described in Section 1.2. Management Goals and their relationship to the RAOs are described in Section 1.3.

## 1.1 IMPORTANT DEFINITIONS

Explicit definition of several key terms help in interpretation of the RAOs and Management Goals and are provided below. As RAOs and Management Goals are refined, additional definitions may be added to provide greater clarity.

**Sediments.** Sediments are defined as soils, sand, organic matter, or minerals that accumulate on the river bottom. Sediment is defined to include both the solid and pore water (also sometimes termed interstitial water or Transition Zone Water [TZW]) portions of the sediment matrix. RAOs for sediment are intended to include modes of toxicity that occur, consistent with the findings of the risk assessment, either primarily through the solid or pore water portions of the sediment matrix or both. Sediment is specifically defined to include pore water in areas of potentially stranded groundwater plumes that have been shown to pose in-river risks, based on the understanding that certain volatile COCs primarily occur in pore water.

Sediments extend up to the mean high water mark (13.3 feet NAVD88) (as referenced in the Round 2 Comprehensive Report and the LWG's April 7, 2006 responses to EPA's Identification of Round 3 Data Gaps and Proposed Round 3 Scope of Work) along the banks (including beach sediments assessed in the human health risk assessment) within the Portland Harbor Superfund Site. Riparian soils are found along the river banks from the mean high water mark to the ordinary high water mark (20 feet NAVD88) and are not defined as sediments.

**Biological Active Zone (BAZ).** The biologically active zone is the depth to which exposure to benthic organisms occurs. This depth varies throughout the site based on the nature of the sediment bed and the type of benthic organism present. The vertical depth of the BAZ in surface sediments will need to be defined based on remedial investigation and risk assessment data and evaluations. The primary information available for defining the depth of the BAZ is the sediment profile imaging (SPI) data from the Study Area. As a practical matter, for the evaluation of surface sediment COC concentrations, data from surface sediments collected between 0 and 30 cm depth will be used to represent conditions in the BAZ. Other FS evaluations that are not solely dependent on surface sediment data, such as cap effectiveness and Monitored Natural Recovery (MNR) predictions, may use other technically defensible estimates for the BAZ.

**Comment [c2]:** It is critical to include in the definition of sediments the concept of pore water, so that is clear what impacts are being addressed through a "sediment" remedy (i.e., porewater and TZW impacts are also addressed).

**Comment [c3]:** The term groundwater should be used to refer to subsurface water emanating from an upland source and discharging to the river. Use of this term synonymous with "pore water" confuses what is being addressed by a sediment remedy in areas where groundwater plumes do not exist. Such an approach also confuses the lines of evidence that have been developed to identify sediment risks in situations where upland groundwater plumes do not exist. Additional lines of evidence exist to assess the specific situations where groundwater plumes also impact sediments.

**Comment [c4]:** Riparian soils are not part of the site. The AOC distinguishes between upland and in-river areas and the MOU between DEQ and EPA indicates that bank soils above mean high water are the subject of upland cleanups regulated by DEQ.

**Comment [c5]:** It is agreed that where evaluations are totally reliant on the data from the 0-30 cm interval, this practical definition of BAZ is necessary. However, the LWG disagrees that this limits the use of more accurate BAZ intervals for other evaluations that are not solely dependent on surface sediment chemistry data per the examples in this paragraph.

## 1.2 SEDIMENTS REMEDIAL ACTION OBJECTIVES

Based on the above overarching context, the sediments site RAOs below are proposed by the LWG for the Portland Harbor RI/FS.

### Human Health

**RAO 1 – Reduce to acceptable levels human health risks from exposure to contaminated sediments resulting from incidental ingestion of and dermal contact with sediments and comply with identified ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO.**

This RAO applies to direct human health sediment exposure scenarios found to have an unacceptable risk in the risk assessment. The goal is to achieve acceptable risk levels, comply with chemical-specific ARARs that are applicable to the exposure media through the exposure pathways and receptors addressed by this RAO, and protect beneficial uses of the Willamette River related to this RAO. This goal will be achieved by reducing COC concentrations in sediments and preventing human exposure to contaminated sediments through sediment remedies for chemicals that exceed risk-based threshold concentrations as defined by the risk assessment for sediment at the site.

**RAO 2 – Reduce to acceptable levels human health risks from indirect exposures to COCs from sediment through ingestion of fish and shellfish that occur via bioaccumulation pathways from sediment and/or from sediment to surface water and comply with identified ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO.**

This RAO applies to sediments that, through fish and shellfish consumption scenarios, are found to have an unacceptable risk in the risk assessment. The goal is to reduce risks through sediment remedies to levels that protect humans from indirect exposures to COCs through eating fish and shellfish that are exposed to COCs from sediments via bioaccumulation and bioconcentration; comply with identified chemical-specific ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO; and contribute to the protection of beneficial uses of the Willamette River related to this RAO. This RAO is expected to contribute to the reduction and elimination of Portland Harbor PCB fish consumption advisories, to the extent appropriate, through reduction in sediment chemical contributions to fish tissue. It is recognized that reduction and elimination of the Portland Harbor fish advisory can only be achieved when conducted in conjunction with other Portland Harbor source controls and other PCB reduction efforts conducted under other regulations and programs within the Willamette River watershed, as described in the Source Control Management Goal below.

**Comment [c6]:** Per the definition comment above, the term "sediment" includes pore water, and therefore, the water component of sediments does not have to be separately referenced within the RAO. In particular, EPA's use of the term "groundwater" within sediment RAOs confuses what is being addressed by the RAO, per the comment above on sediments definition. This comment applies to all RAOs.

**Comment [c7]:** We disagree that the ARARs should be referenced in the actual RAO. Consistent with guidance the ARARs should be identified based on the RAOs. However, we can agree to the text as edited here that recognizes the RAO first and compliance with identified ARARs second. Language regarding the applicability of ARARs also needs to be included to recognize that the ARARs should be determined based on the RAOs. This comment applies to all RAOs.

**Comment [c8]:** We agree that beneficial uses related to this RAO should be protected through the RAO. This edit applies to several other RAOs as well.

**Comment [c9]:** We have deleted redundant references to the definition of sediments from within the supporting text of each RAO. We believe it is clearer to state this once in the sediments definition above.

**Comment [c10]:** Bioaccumulation RAOs need to recognize that the focus of a sediment remedy is those chemicals coming from sediments either directly or through the intermediary pathway of surface water. This is consistent with the guidance Section 2.4.1 cited in our introductory text including the concepts that, "When developing RAOs, project managers should evaluate whether the RAO is achievable by remediation of the site or if it requires additional actions outside the control of the project manager." and "...RAOs should reflect objectives that are achievable from the site cleanup." Several other edits to this RAO are intended to clarify this linkage to sediments.

**Comment [c11]:** EPA changed the wording from "reduce COC concentrations" to "achieve acceptable risk levels" in RAO 1. Similar phrasing such as "reduce risks" is just as applicable to this RAO (and others). Guidance calls for a risk-based approach, and consistent with this, the goal of the RAOs should be reduce risks, not reduce COC concentrations. Reducing concentrations is one tool that can be used to reduce risks and one measurement endpoint that can be used to assess the performance of the remedy.

**Comment [c12]:** The last two clauses of this sentence more clearly define how the remedy is expected to contribute to meeting the fish consumption advisories and should be retained. This provides context to the next sentence, which EPA retained, and which describes the other activities that are expected to also contribute to meeting these advisories.

**RAO 3 – Reduce risks from the contribution of sediments to COCs in surface water at the site to acceptable exposure levels that are protective of human health risks from incidental ingestion of and dermal contact with surface water and comply with identified ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO.**

This RAO applies to direct human health surface water exposure scenarios found to have an unacceptable risk in the risk assessment. The goal is to reduce risks from the contribution of sediments to COC concentrations in surface water to the extent practicable through sediment remedies to levels that protect humans from the incidental ingestion of and dermal contact with surface water; and comply with identified chemical-specific ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO .

#### Ecological

**RAO 4 – Reduce to acceptable levels the risks to ecological receptors resulting from the ingestion of and direct contact with contaminated sediments and comply with identified ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO.**

This RAO applies to all ecological receptors found to have an unacceptable risk in the risk assessment via direct sediment exposure. The goal is to reduce risks to ecological receptors from COC concentrations in contaminated sediments through sediment remedies at the site; to prevent unacceptable effects on the survival, growth, and reproduction of ecological receptors ; and comply with identified chemical-specific ARARs applicable to exposure media through the exposure pathways and receptors addressed by this RAO.

**RAO 5 – Reduce to acceptable levels risks to ecological receptors from indirect exposures through ingestion of prey to COCs in sediments via bioaccumulation pathways from sediment and/or from sediment to surface water and comply with identified ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO.**

This RAO applies to all ecological receptors found to have an unacceptable risk in the risk assessment through ingestion of prey. The goal is to reduce risks from COCs in sediments through sediment remedies to levels that protect ecological receptors from exposures to COCs through eating fish and shellfish, benthic organisms and other prey items that are exposed to COCs in sediments via bioaccumulation and bioconcentration; comply with identified chemical-specific ARARs applicable to the exposure media

**Comment [c13]:** Surface water RAOs need to recognize that the focus of a sediment remedy is those chemicals coming from sediments. This is consistent with the guidance Section 2.4.1 cited in our introductory text. Several other edits to this RAO are intended to clarify this linkage to sediments.

**Comment [c14]:** The risk assessment addresses "incidental" ingestion, and therefore, this word should be included in the RAO. Without this word the RAO implies drinking water exposures. The draft human health risk assessment did not find water concentrations greater than drinking water MCLs when data were spatially averaged as directed by EPA, other than instances that are attributable to background levels in river water. This issue should be excluded from the RAOs at least until such time that EPA reviews the human health risk assessment and determines it disagrees with this determination. In addition, the LWG maintains that the long term consumption of untreated river water is not a beneficial use of the Lower Willamette River.

**Comment [c15]:** See comment on the RAO 2 regarding bioaccumulation RAOs.

through the exposure pathways and receptors addressed by this RAO; and contribute to the protection the beneficial uses of the Willamette River related to this RAO. This RAO is expected to contribute to reduction of prey ingestion related ecological risks through reduction in sediment chemical contributions to fish tissue. It is recognized that reduction of and elimination of these risks can only be achieved when conducted in conjunction with other Portland Harbor source controls efforts conducted under other regulations and programs within the Willamette River watershed, as described in the Source Control Management Goal below.

**Comment [c16]:** EPA accepted language very similar to this for RAO 2 on human health bioaccumulation. Consequently, we assume that EPA can agree to similar language for this ecological bioaccumulation RAO.

**RAO 6 – Reduce the contribution of sediments to COC concentrations in surface water at the site to acceptable exposure levels that are protective of ecological receptors based on the ingestion of and direct contact with surface water and comply with identified ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO.**

**Comment [c17]:** Surface water RAOs need to recognize that the focus of a sediment remedy is those chemicals coming from sediments. This is consistent with the guidance Section 2.4.1 cited in our introductory text. Several other edits to this RAO are intended to clarify this linkage to sediments.

This RAO applies to all ecological receptors found to have an unacceptable risk in the risk assessment via surface water. The goal is to reduce risks from sediment contributing to COC concentrations in surface water to the extent practicable through sediment remedies to levels that prevent unacceptable effects on survival, growth, and reproduction of ecological receptors; comply with identified chemical-specific ARARs applicable to the exposure media through the exposure pathways and receptors addressed by this RAO; and contribute to the protection of the beneficial uses of the Willamette River related to this RAO.

**Comment [c18]:** In RAO 3, which is also a surface water RAO, EPA accepted adding language "to the extent practicable". Consistent with that approach, this surface water RAO should have similar language included.

### 1.3 ADDITIONAL MANAGEMENT GOALS

In addition to the RAOs stated above, there are several Management Goals that promote consistency in the wider context of the sediment cleanup and the overall comprehensive improvement to the river environment and watershed. These management goals are as important as the RAOs, but define goals that are 1) not the direct reason for conducting the sediments CERCLA project (i.e., cleaning up contaminated sediments); 2) need to be carried out in whole or part by other parties under other regulatory authorities in conjunction with the site RAOs and the sediment cleanup; or 3) to identify remedial strategies that would enhance aquatic habitat consistent with action-specific ARARs that will be applicable to remedial actions. These management goals will be used in the FS to enhance the overall remedy for the site.

**Comment [c19]:** It is important to make clear that this obligation does not extend beyond Section 404/401/ESA for actions taken during the sediment remedy.

Site-wide Management Goals are those goals that may be considered in the FS to help ensure a successful remedy and that would require integration with other regulatory mechanisms to implement. Specific numeric PRGs and remediation goals are not expected to be developed for these management goals by the LWG for their part in developing the Portland Harbor FS for the in-water portion of the Site. They will be considered in the development of in-water remedial alternatives, assessing compliance



with ARARs including section 404 of the Clean Water Act and the Endangered Species Act and as part of the evaluation of long term effectiveness and permanence, implementability, and compatibility with anticipated future uses. EPA expects that upland source control measures will be conducted so as to achieve RAOs established for the in river portion of the Portland Harbor Site.

**Comment [c20]:** The edited text is removes implications that the in-river parties are responsible for achieving these source control measures.

**Management Goal 1 – Ensure sediment cleanup activities consider, compliment, and are compatible with, upland and upstream source control efforts designed to prevent in-river recontamination by COCs in groundwater, stormwater, soil erosion, upstream sources and overwater activities at the site and are consistent with the RAOs for the site; and allow in water remedies at the site to proceed in a timely manner.**

**Comment [c21]:** We have deleted reference to ARARs here because this is a management goal, not an RAO. There cannot be an ARAR obligation from a management goal. However, we have added that the goal should be consistent with the RAOs, which thereby relates the management goal to the ARARs specified in the RAOs.

This management goal recognizes that a successful site remedy includes the implementation of effective in-water remedies and upland source measures. The goal is to have a sediment cleanup that supports and is compatible with upland and upstream source controls that prevent sediment recontamination after cleanup. Further, sediment remediation activities should not hinder upland source control actions and water quality programs being implemented by Oregon DEQ. Upland and upstream source identification and control is being regulated and directed by Oregon DEQ working with other entities within and outside Portland Harbor. The goal of these source controls is to the extent practicable to reduce risk and prevent the unacceptable recontamination of cleaned up sediments. Upland source control activities need to be implemented in a timeframe and manner that reduces risk and minimizes the potential for recontamination by COCs in groundwater, stormwater, soil erosion, and over water activities at, and upstream from the site and are consistent with and facilitate the achievement of site cleanup goals and compliance with in-river ARARs. The FS will include an evaluation of the potential for in-river risks and recontamination from ongoing upland and upstream sources as allowed by existing data and information. The FS will estimate, as existing information allows, the source reduction levels on a site-wide basis that would be expected to meet various potential sediment and water PRGs including the uncertainty of such estimates. The FS will not attempt to estimate the source reduction actually provided by various individual potential, planned, or implemented source controls at properties along the river or the watershed as a whole. With regards to riparian soils, there may be cost savings by integrating sediment remedies along the shoreline with upland source control efforts. Upland source control efforts will address riparian soils that are likely to have a direct effect through the erosion of bank material upon sediments and surface water below the mean high water mark. Factors that will be considered to determine whether riparian soils are likely to have a direct effect on sediments include the characteristics of the river bank, the presence of contamination and the status of upland source control efforts.

**Comment [c22]:** We are unclear why EPA would want to delete this statement of fact, which is relevant to understanding how source control works at the site. If EPA disagrees with this statement, we would want to discuss further why.

**Comment [c23]:** It is appropriate to use wording like this for upland source controls, and such wording is consistent with practicality language we are recommending for the RAOs. However, if EPA does not allow such language in the RAOs, to be consistent, it should also be struck from this management goal.

**Comment [c24]:** EPA's text referred to "ARARs in the ROD". Because the text does not otherwise mention ARARs in the future ROD, for consistency this should be reworded here.

**Management Goal 2 – To the maximum extent practicable, minimize the long-term transport of sediment COCs in the Willamette River from the site to the Columbia River and the Multnomah Channel.**

The goal is to prevent the migration of sediment COCs at levels that would potentially pose unacceptable risks to human health and ecological receptors downstream of the site. Sediment cleanup alternatives will be evaluated in the FS under the long term effectiveness criterion to clearly estimate, as existing information allows, whether unacceptable downstream transport would be minimized (or not) by each alternative. Minimization of downstream COC transport will be a clear sub-criterion presented in the FS under the more general long term effectiveness criterion.

**Management Goal 3 – Clean up contaminated sediments in a manner that promotes habitat that will support a healthy aquatic ecosystem and the conservation and recovery of threatened and endangered species.**

The goal is to ensure that sediment cleanup alternatives selected for the site consider the benefits of re-establishing ecological habitats in those areas remediated to support a diverse ecosystem. Sediment remedial actions must comply with ARARs, including the Clean Water Act compensatory mitigation and Section 404(b)(1) analysis and the Endangered Species Act. Other potential ARARs may include the Marine Mammal Protection Act and/or Migratory Bird Treaty Act. The need for habitat mitigation in conjunction with the remedial action alternatives will be evaluated for each detailed sediment cleanup alternative in the FS under the long term effectiveness and compliance with ARARs criteria and cost estimate analysis. For each detailed alternative, the FS will evaluate reasonably anticipated future land use with respect to habitat. The FS will also clearly describe the degree to which habitat mitigation needs to be included to meet substantive requirements of potential ARARs. To support this evaluation the LWG is seeking a programmatic approach to addressing ESA issues with NOAA (including a programmatic consultation) to help appropriately define the habitat impacts from remediation and types of desirable mitigation. A programmatic approach would support a more comprehensive and integrated watershed evaluation to promote the conservation of species. For each detailed alternative, the FS will clearly describe whether habitat mitigation needs to be included to meet the substantive requirements of potential ARARs. This does not include evaluation of any potential or needed restoration activities under the Natural Resource Damages Assessment (NRDA) provisions of CERCLA, the Clean Water Act, and the Oil Protection Act (OPA).

**Comment [c25]:** We are unclear why this text was deleted by EPA. Is EPA not supporting LWG in this objective? If so, this requires further discussion to determine why.

**Comment [c26]:** We are unclear why EPA deleted reference to CWA and OPA here. NRD restoration is not limited to CERCLA.